ENGINEERING EDUCATION

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PRESIDENT'S FOREWORD.

"Send December 'Foreword' on Branches to printer at once." This gentle telegraphic suggestion from our Secretary-Editor makes one wish for a fluent supply of inspiration and ideas ready to crystallize into instantaneous copy for the printer. What more is there for me to say about Branches? I have been advocating and urging them in season and out of season for a year or more. My thoughts have been directed recently to other activities, the preparation of the report of the Development Committee, the way to properly start the activities which the report outlines, and the relations with industries through the Advisory Committee in connection with the National Industrial Conference Board.

When the Development Committee met early in July it expected that its report would be completed at the end of the day but late in the afternoon it was decided that another day would be necessary. On the afternoon of the second day, when the report was nearly completed, the work was halted by the comment of one of the members that the report as it was then drafted was formal and cold, it lacked the life and vitality which had been in our thought and in our discussion. We had been discussing the desirability of getting into the schools a new and larger and developing ideal of the place of the engineer in the next generation. We had planned to have visits to the schools which would bring interest and inspiration. We had looked to the increasing interest of engineering teachers in the larger problems of the profession and of their own work. We had contemplated an active, self-exciting activity in each school as one of the ideals in developing and enriching engineering education; but the draft of the report was formal and inexpressive. It was remarked that the report itself might seem to contemplate simply the work of some super-committee off by itself preparing a form-

ula for engineering education to be issued after four or five years. The report was changed, another day was spent on it and then it was laid over for further consideration at a meeting the following week. But even after further revision the final wording of the report (which was the work of Dean Cooley) does not emphasize the vital, active part which the schools themselves should take. To be successful this must be a movement of the schools, by the schools and for the schools. If they are not interested, if they do not care, if they do not themselves rise to meet the situation, then a large factor in the plan fails to function. In the last analysis engineering education is largely an individual matter. It is the power of the individual teacher which really counts.

Now what has all this to do with Branches? It has a great deal. The Branch is an organization in individual schools through which the teachers of engineering students meet to work out their common problems. They may lay emphasis on how to teach, they may take up and study any one of many problems which make for better engineering education. They may well take up such questions as the qualifications or specifications for a good teacher, or they may attempt to prepare specifications for the graduate by naming the essential characteristics which the school should aim to develop in its graduates. They may well have papers and discussions on the changing field of activity and opportunities of engineering graduates which the future holds in store and discuss what qualities should be emphasized in preparing men for these new needs.

In brief, the Branch holds in itself the possibility of being one of the most direct and powerful agencies for carrying out the spirit and intent of the report of the Development Committee. Suppose, for example, the Branches should now take up the report of the Development Committee in the September BULLETIN, discuss its aims and methods, consider in what way the individual Branch or its institution may do its part in the plans proposed and send to the new Board of Investigation and Coördination its views

and its suggestions as to the way in which the Board could effectively undertake its work. I am sure the spirit and interest as well as definite proposals would be most helpful to the Board.

Is not the Branch a direct and effective means of carrying out the aims and purposes of the Society and bringing its activities directly to the individual teachers?

THE ADVANTAGES OF THE LECTURE SYSTEM OF TEACHING IN A TECHNICAL SCHOOL.

BY W. R. VEAZEY,

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It is our observation that a vast amount of valuable time has been wasted in the discussion of subjects of this character because of the fact that no definition of the things under consideration has been made by many of the various authors. Many teachers of Latin and Greek make sweeping assertions about general methods of teaching and some professors of mathematics are prone to lay hard and fast rules for the guidance of all teachers. Doubtless, the art of teaching can be reduced to an algebraic equation and the problems of the schoolmaster solved by the aid of an integrating machine!

The maker of bricks cannot use the same tools and machinery as the producer of cane sugar, and yet both may be highly successful in their art. The machinery must be chosen in accordance with the nature of the materials handled, in teaching, as well as in industry. The public makes but one demand on industry, namely that the products of industry be of good quality, well suited to their uses, adequate to the public needs in quantity and of reasonable cost.

So also in teaching the demands on the teacher should be made with respect to the results of his teaching as judged by the success of his students in after life and great freedom of action should be allowed to, and exercised by, the teacher in meeting the great variety and ever-changing conditions which confront him.

In order that our survey of the "Advantage of the Lecture System of Teaching in a Technical School," may reach some definite conclusion, we must establish certain well-defined base lines. We must avoid the mere asking of questions without

offering any definite answers, as this would result largely in a waste of valuable time on the part of all of us.

We have frequently observed in our reading of articles on educational subjects that many problems are presented but few conclusions are reached, and this reminds us of the story of a Scotch preacher who asked Sandy, one of his parishioners, how he liked the Sunday morning sermon and received the reply, "I didn't like it." "Why not, Sandy?" "Well, in the first place you read it; in the second place you did not read it well; and in the third place it was not worth reading." In order to guard as far as possible against such a criticism we will, therefore, define certain basic ideas pertaining to the question before us, and shall place rather narrow limits on the scope of our argument.

What do we mean by the term "teaching?"

To some persons the only answer to this question is: "It is a method of earning a living after all other attempts have resulted in failure."

To others, the answer seems to be: "It is a means of paying board bills immediately after graduation from college, until such time as the opportunity for other kind of employment arises."

To others, the answer is: "It is a kind of employment which is safe and secure, since one is never 'fired' after being 'hired' so long as his moral behavior is above reproach."

To a few, teaching is a life-work, the purpose of which is to assist in the process of making mature, substantial citizens out of persons whose minds are still adolescent.

To this last group of teachers the personal reward is not money, security of position, temporary convenience, or even public honor, but rather the satisfaction which follows from a life spent in the service of mankind.

In the opinion of the writer the very greatest care should be exercised in the selection of teachers, to see that as far as possible they belong in the class whose definition of teaching embraces the idea of a life-work, because this quality in a teacher

has a profound influence on the results obtained from any system of teaching.

Teaching involves a course of study, which has some definite objective. These objectives present an infinite variety of purposes but for convenience we will place them in two very general classes.

First: Studies designed to increase the knowledge of the student, with reference to the spiritual or the esthetic side of his nature. For example, studies in religion, philosophy, art, or literature. Second: Studies designed to fit the student for production of material benefits for his fellowmen. For instance, studies in the various branches of engineering and in medicine.

We fully recognize the fact that both of these classes of study are essential to the development of the highest type of citizenship and that they of necessity overlap in a countless number of ways. We must, therefore, sharply limit ourselves to the topic before us if we are to escape a maze of vague generalities. Let us discuss only the teaching of engineering subjects, which has the specific end in view of enabling the student to act for himself when production problems are placed before him.

There are three types or systems of teaching in actual use which we will designate as: the Lecture System, the Textbook System; and the Laboratory System. There is of necessity much intermingling and overlapping of these systems in actual practice and to again prevent too great diffusion of our thought we will further confine our remarks to those phases of engineering teaching to which either the Lecture System or the Textbook System may be exclusively applied. We have thus considered the Laboratory System to be merely an adjunct to one or the other of our selected teaching systems.

What is the Textbook System of teaching? It consists of definite page or chapter assignments in a textbook, supposed to contain a full explanation of all matters to be studied. The student studies these assignments and the teacher finds out

what the student has learned by oral recitations on each assignment. An occasional written lesson is given by way of review. This method gives the student great confidence in a printed page and to a degree tends to develop an excellent variety of human phonograph.

This is the kind of instrument that is usually turned on for the delectation of the School Board when it visits "Ye district school," but as an instrument for the production of creative ability and personal initiative it is a decided failure.

One of the difficult problems of an engineering teacher is to train the student to accurately separate the false from the true information that is set forth in technical literature. The students' faith in the accuracy and truth of whatever is written in a book is almost unshakeable and this is due, we think, to the fact that all of his training previous to entering college has been of the textbook variety. Until he is properly trained we are continually assailed with the complaint, "But the book says so."

What is the Lecture System of teaching? Broadly speaking, it consists of one or two lectures by the teacher in which he outlines the subject in hand in such a way as to emphasize the fundamental principles, giving only such detail as may be necessary to make these fundamentals clear to the student.

These lectures are accomplished by textbook and reference study on the part of the student following the outline of the lecture. The object of this study is to fill in the outline with detailed information such as will enable the student to then write a complete set of notes. It is very essential that the student be required to write out his notes in the manner indicated, as this fixes the subject in his mind in a very definite and permanent way, and does not leave him with a few vague generalities as the result of his study.

The subject matter covered thus far is now reviewed by an oral recitation in which the teacher discovers just what has been comprehended by the student. Thus one cycle of the process is completed. The second cycle begins with a lecture,

a portion of which is devoted to the elimination of errors brought to light during the recitation period and then proceeds, as before, with the exposition of new matter, in one or at most, two more lectures, followed as before by reference study, note writing, and oral recitation. After one general topic has been covered in this way, it is reviewed by a written lesson or test which is so designed by the teacher as to give the student a bird's-eye view of the work he has done.

This system of teaching is, of course, subject to certain variations, according to the nature of the subject matter, the number of students, the amount of time allotted to the course, and the number of instructors available for notebook inspection and recitation work; but in any case, the spirit of the method can be maintained, that is—the student is guided as to the direction his work is to take, but he is compelled to do the work for himself.

The student must be trained not only to do his own work but to do his work on time and work done by make-up processes should never be allowed more than a passing grade, because if a man is always behind time, industry will discard him at an early date and justly so.

One of the bad features of college work today is the deliberate teaching that work not done on time can be made up some other time with little or no discredit to the student. Courses of study should be so arranged that all students of passing grade can do their work on time, if they work reasonably well, and a severe penalty should be placed on all tardiness. We freely admit that many courses of study as at present arranged, practically compel time extensions to the lower grades of students, but we greatly deplore the situation.

The engineering student, above all things else, must be trained to become self-reliant, analytic in his thinking, and definite in his conclusions. These qualities cannot be developed by mere accumulation of knowledge. A well-conducted lecture course simulates to a marked degree an efficiently managed

debate on the subjects in hand, and should never degenerate into a dogmatic statement of facts by the teacher.

Spoon-feeding is excellent for small children and invalids but men of brain and brawn can be developed only by a constant hard struggle.

The great object of all teaching in a technical school should be to train men to think, and a necessary secondary object must be to train them in the methods of finding the detailed facts on which to base their thinking.

We do not regard a course of lectures, extending over a number of weeks, and followed by a single written examination as falling within the category of any system of teaching. It is a plan by which the would-be teacher follows the line of least resistance in order that he may have more time for the pursuit of his favorite research. It is a device of Morpheus for lulling the student into a state of mental stupor from which he is awakened once or twice a year by the prospect of a final examination to-morrow, which must be crammed tonight and promptly and fully forgotten the next day.

The value of any good system of teaching depends chiefly on two things: the teacher and the student. Both teacher and student should be carefully selected with respect to his adaptability to the particular course of study which is to be undertaken. Although Dr. Little of Boston has at last succeeded in "making a silk purse from a sow's ear" yet he freely admits that the purse is of small value as a purse and that it cost far more than its ultimate use could in any sense warrant.

In passing let us note that as a general rule the teachers in technical schools are carefully selected and the average quality of such teachers is high, but as yet no really efficient method has been put into practice for the selection of students for engineering courses.

Many potentially excellent salesmen, lawyers, journalists, and politicians and some potentially efficient ditch-diggers, blacksmiths, and dry goods clerks are still admitted to courses

in various branches of engineering to the mutual detriment of student and school.

If either the teacher or the student is lacking in character, honesty, definiteness of purpose, or mental capacity, the results of the teaching will be far below the standard which should be maintained.

We are thoroughly convinced from our past experience that more can be accomplished for the wide-awake, purposeful student, by the lecture system of teaching, as we have defined it, than in any other way. It provides a means of personal contact, a contact which can and does create and maintain an interest in the future life-work of the student which cannot be aroused by the reading of any kind of a printed page. But this, of course, depends to a large degree on the personality of the teacher, for success.

If the teacher is lazy and inclined to give lectures in a perfunctory manner, as he reads from notes which are dog-eared from much handling, and yellow from excessive age, little need be expected by way of useful results from the lecture method of teaching. The student will sleep through the lectures, and indeed, without much personal loss, and the lecturer will drone along year after year until some merciful Foundation places him on the pension list or the President of the College gently but firmly persuades him to begin realizing profits from his accumulated annuity fund.

We hasten to say that such a case has never come under our observation and is so far as our actual experience goes, a figment of our imagination created for the purpose of disarming certain critics of the lecture system of teaching, who would have us believe that all lecturers and lecture courses lead to a bad end.

It is possible that some examples of the indolent lecturer may be found among teachers of dead languages on certain university faculties, but we are certain that they cannot be found among technical men who are sufficiently fond of teaching to spend their lives at school salaries, when the larger

financial rewards of industrial work are so freely offered. The average technical lecturer is enthusiastic about his subject and is well informed concerning its most recent developments. He keeps in close contact with men engaged in plant management and production work and he makes frequent visits to manufacturing plants. He is frequently to be found spending his vacations in the employ of some industrial establishment and if he has a proper personality his graduates come back to visit him, bringing with them much valuable information fresh from plant practice.

Every class of students taken collectively presents a new personality to the teacher and the lecture method affords the opportunity to the teacher to vary his presentation of a subject in such a way as to best reach the particular class which is before him. Very often the method of presentation must be altered during the course of the lecture as some new side of the class personality comes to light. This cannot be done by textbook methods.

The good lecturer is constantly alert in his manner of speech; in his appreciation of the students' limited viewpoint and capacity; and in his knowledge of the general use to which the subject under consideration is likely to be put in the later life of the student.

He puts all his energy into each lecture and, by expenditure of his personal force, stimulates a desire on the part of the best students to make a much deeper study of the things presented than is attempted by the ordinary student. He keeps the student in touch with such practical applications of the more theoretical studies as come under observation from time to time.

We are reminded of an incident which occurred a few years ago. The chief mechanical engineer of a large chemical plant remarked that the life of a professor in a technical school was an ideal life of ease. The head of the department of Chemical Engineering in one of the leading technical schools, who overheard this engineer's remark, promptly invited him to give a

course of five lectures, one lecture per day, on plant design, to the senior students in Chemical Engineering. The invitation was accepted and a most excellent series of lectures was given, but at the end of the fifth lecture the engineer said, "I am all in and will be glad to get back to the plant and get a little rest."

The efficient lecturer is usually physically tired after each lecture and not infrequently dies before the pension or annuity board can get hold of him, unless he has a specially rugged constitution.

If the lecturer is to maintain this high efficiency in his work, much depends upon the scheduling of his work. If the lecture schedule calls for two or three lectures on the same or different subjects in two or three consecutive hours, it is practically impossible for the teacher to put a great amount of enthusiasm into the second lecture and the third is a dull performance.

It is quite essential, also, that an hour or two per day be available to the lecturer in which he is free from executive work or shop or laboratory supervision, in order that he may satisfactorily keep in touch with current literature and have time to do clear, mature thinking in the problems of his profession.

In teaching technical subjects such as Applied Electro-Chemistry, Chemical Technology, Plant Design, etc., we are confronted by the fact that such textbooks as are available are rarely written by men who are in contact with the industries and consequently these books are inaccurate and are frequently ten or twenty years out of date. Lest we be charged with extravagant statements with regard to the inaccuracy of textbooks, let us consider two or three quotations from standard texts. Nearly all textbooks on general chemistry in discussing the electrolysis of aqueous solutions of sodium chloride, assert that metallic sodium is liberated at the cathode during electrolysis and that this sodium then reacts with water with the liberation of hydrogen which is the final product obtained from the electrolytic process. These same texts also give tables of

electrolytic single potentials which show that at most, 0.28 volt at the cathode is sufficient to liberate hydrogen and for the liberation of sodium, at least 3.10 volts are required. It does not require a specialist in electro-chemistry to see the inconsistency in this case. An author of a very recent text in general chemistry states in the earlier part of his book that sodium is liberated and then reacts with water to liberate hydrogen, and in the latter part of the same book, states that the sodium is not liberated at all, but that the hydrogen is directly discharged to the electrode. What must the textbook student conclude?

But perhaps this illustration is not clear to all. Let us quote from Rideal's "Electro-Metallurgy," in which he says under a description of the manufacture of metallic magnesium, that the metal must be protected while molten by an atmosphere of an inert gas such as nitrogen or carbon dioxide. Anyone acquainted with the actual manufacture of magnesium knows that both nitrogen and carbon dioxide act very readily on hot magnesium.

On page 99 of Molinari's "Industrial Organic Chemistry" under a discussion of the uses of chloroform we read: "In America, chloroform is used to render pigs insensible so as to kill them painlessly and to skin them more easily. Also in fattening them, they are subjected to periodic inhalations of chloroform, which renders them more restful." It is very evident that some authors of textbooks do not keep in close contact with the industries.

Even reference books and periodicals are always several years behind actual plant practice and are occasionally out of date with reference to modern theory.

Manufacturers rarely release information on their processes for publication purposes, until such time as new information makes it quite certain that the newer processes are more economical than the old and even then many essential details are eliminated from the publication.

One of the largest sources of reasonably fresh technical in-

formation is the patent literature, but this class of publication must be taken with many "grains of salt" and much expert discrimination.

In the teaching of highly theoretical subjects, like Physical Chemistry, there is a very unfortunate state of affairs among the textbooks, in that nearly every such book has apparently been written for the purpose of showing what the author would wish his readers to think that he, the author, knows, or for the purpose of advancing certain pet theories, rather than from the standpoint of teaching the student the fundamentals of the subject in such a way that he can make use of them in the practice of his profession in after life. Dr. Ira Remsen, while president of Johns Hopkins University, once remarked that "Authors of Physical Chemistry textbooks seem to be trying to make Physical Chemistry a clothesline on which to hang mathematics rather than a means of teaching ideas to the average student."

In conclusion, we assert that the Lecture Method of teaching as we have defined it, is the most efficient method of teaching technical and related theoretical subjects in a technical school.

A NEW COURSE IN MACHINE SHOP PRACTICE.

BY O. W. BOSTON,

Assistant Professor of Shop Practice, Acting Director, Engineering Shops, University of Michigan.

The need of trained men in production engineering was brought out in "A Study of Engineering Education" by Dr. C. R. Mann of the Carnegie Foundation, and further discussed by Prof. J. Airey in the S. P. E. E. BULLETIN, No. 6, 1921, in "The Scarcity of the College Trained Engineer in Production." As a result of this condition which has existed for years, the course in machine-shop practice at the University of Michigan has been modified to substitute for manual training work which will provide the student with a broader view-point of present day machine-shop practice and at the same time emphasize the economic features of repetition work.

Most of the manufactured articles on the market today are made by the so-called quantity production methods. Production methods, materials and design are so related that each has its important effect upon the others. The manufacture of an article in large quantities permits the standarization of materials, machines, tools, labor, methods, etc., so that the parts are not only identical and interchangeable but produced at a very low cost. Most colleges have not kept abreast of the manufacturing methods in training students for industrial work. A few are granting degrees in engineering management, industrial engineering, etc.; the field of production engineering alone has possibilities enough to warrant the turning out of a much larger number of men trained in this line.

Until the winter of 1920, the course in machine-shop practice consisted of eight hours of laboratory work and one hour of recitation per week. The laboratory work was devoted exclusively to a series of standard exercises involving the use

of the various machines commonly found in a tool room or jobbing machine shop. The classroom work was based on assignments from W. S. Leonard's text "Machine Shop Tools and Methods."

The course at present is designed to give a student the general fundamentals of production and to acquaint him with its possibilities. The lectures cover sixteen class periods, of one or more subjects to the lesson. Appendix A gives a general idea of the subjects and their scope. A mimeographed detailed discussion of each subject is prepared for the student to study prior to the meeting of the class. These discussions are an elaboration of the Appendix A and give definite information on the subject, including references, selected assignments from text, definitions, history, development and present practice, together with questions or problems. Lantern slides are used in the lectures to illustrate development or typical machines and set ups.

The laboratory work consists of thirty periods of four hours each as shown in Appendix B. Thirty per cent. of these periods are devoted to standard exercises, such as toolroom work, involving the use of machines not commonly used in production. Seventy per cent. of the laboratory periods are devoted to the manufacture in quantity of two small devices (spring spreaders). This serves as a laboratory example of production and illustrates the various economic features which enter into reduced costs by means of mass production as a result of standardization.

Appendix B shows in addition to the thirty jobs, the machines, jigs, fixtures, gauges, etc., used. It would be impracticable to demonstrate successfully production machinery such as automatic screw machines, turret lathes, jigs, fixtures, gauges, etc., without having material which can be turned out in quantities. The simple routine of labor is also emphasized, although some students look at it as only routine rather than one of the necessary elements of quantity production. This is due, undoubtedly, to inexperience or lack of perspec-

tive. As all operations are being worked on simultaneously the "flow of material" from operation to operation is made apparent.

In order to produce a large variety of parts at low cost, each part requiring several operations, many auxiliaries such as routings, stock records, time study, instruction sheets, etc., are necessary. Figure 1 shows a routing or operation sheet

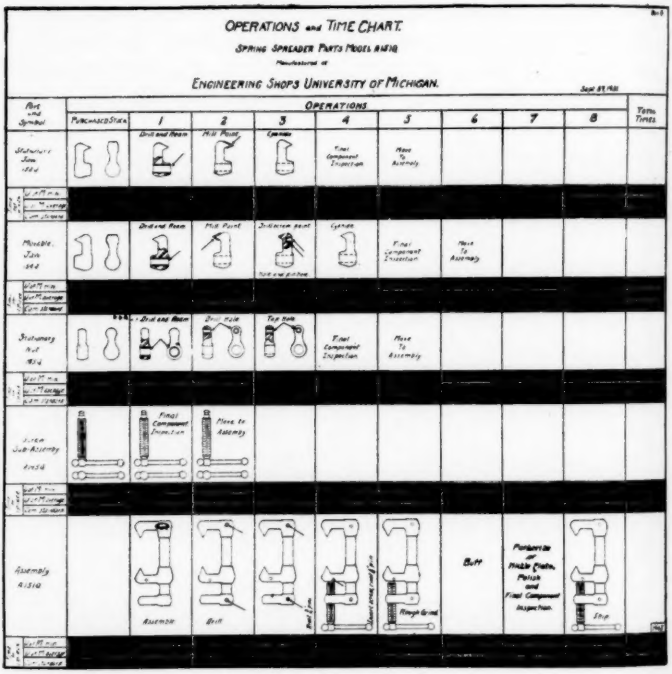


FIG. 1.

for one of the spring spreaders. This gives the number and symbol of each component part and assembly, together with the condition when purchased, and shows by drawings the

subsequent operations. Provisions are made on this chart for the insertion of values determined by time study of the minimum time for each operation, the average time and a commercial standard time. There is a similar operation sheet for the second spring spreader.

The material for the spring spreaders is furnished by an outside party who also sells the finished product. This makes these devices particularly desirable as it relieves the University of any financial concern in the matter. An agreement was made between the Regents of the University and

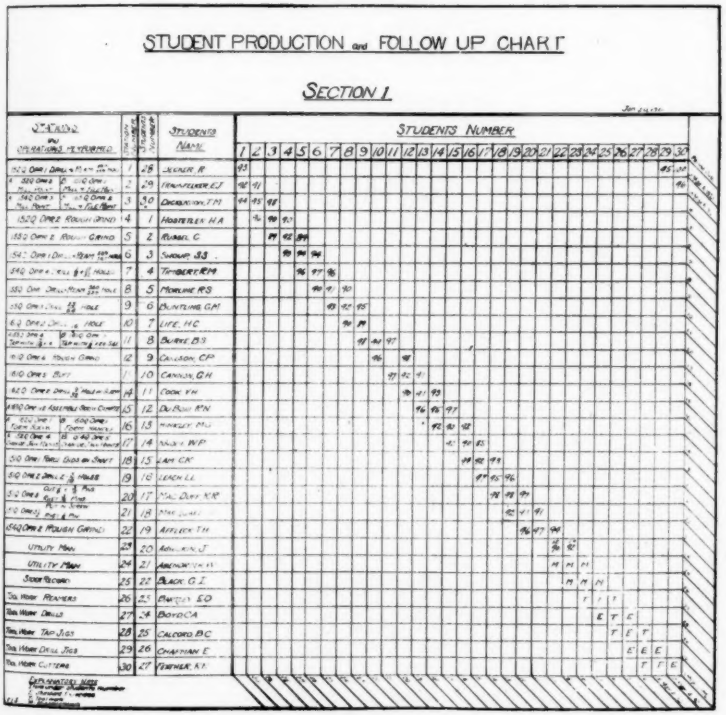


FIG. 2.

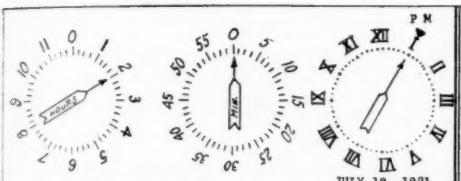
the owner of the material whereby the University receives a price for each spring spreader, slightly below a commercial price, and is in return granted certain concessions such as freedom from obligation to meet delivery schedules and a high scrap allowance.

Figure 2 shows a student production and follow-up chart. This chart lists the jobs or operations of the outline of laboratory work as shown in the left-hand column. Each job is defined by the part number, the operation number and name. The station number indicates the machine or bench at which this work is done. Each student is given a number which is listed next to the station number before his name. At the right of his name is a series of columns, one for each student, his number appearing at the top. His record appears in the vertical column opposite the jobs. For example, student number three did ninety pieces in four hours of part one hundred and fifty-two *Q*, operation two, rough grind at station four. The students' names and numbers are written on an endless roll movable in a vertical direction. The distribution of work during one period is as pictured on the follow-up chart, Fig. 2, showing student number seven working at station number ten. At the next meeting of this section the roll will be moved down one space so student number seven will appear opposite station number eleven. All other students will likewise be advanced to the next operation. By means of this chart each student can see the record of work done and the operation scheduled for the following period. He can become acquainted with this operation so that in the next period he will not require detailed instruction. During a semester each student will cover all of the thirty jobs, regardless of his starting point.

At each station is hung an operation sheet. The instructions give all information, including machine, speeds, feeds, special tools, etc., as well as any precautions. These instruction sheets are to be studied carefully before any operation is begun. Some of the instructions consist of a brief outline of

processes, such as time study, pack and cyanide hardening, stock records, etc., so the student will get as much as possible out of the job.

A stock record book is kept which shows at all times the exact place in process of manufacture of all stock on hand. To accumulate this information, a work ticket is issued covering each transfer of stock. Figure 3 shows the type of work



NO. 1939

PIECE 152Q | STATION 17

OPERATION 3 & 4 Cyanide

ENTERED ON

STUDENT Kolb | NO. 6 | SECT. 2 | INVENTORY 7-19-21 | CHART 7-19-21

TRAY	ISSUED	FINISHED	UNFIN.	STOCK KEEPER	FIRST INSPECT. Accepted	FIRST INSPECT. Rejected	FINAL INSPECT. Accepted	FINAL INSPECT. Rejected
	368	368	0	R.M.			368	0

STUDENT INSPECTOR Kolb | FACULTY INSPECTOR R.L.M. | PIECE RATE $0.0033 | AMT. DUE $1.10

FIG. 3.

ticket used. They are numbered serially so that all tickets can be accounted for. The work ticket is the only authority for performing work or affecting transfers or other changes to the stock records. The number of pieces, station number, operation number and name, student's name, number and section are shown, together with the number of pieces issued, finished or unfinished. When possible the student inspects his own materials upon completion of his work and posts the results under the heading of first inspection. The final inspection is made by a member of the teaching force. A calculograph clock registers the lapsed time. The dial at the right is stamped when the work ticket is issued and shows

the month, day and year, together with the time of day. The small triangle shows the hour, the arrow the minutes. At this time the two dials at the left are also stamped. The one at the extreme left is the hour dial, the one in the center the

OPERATION 1.Assemble shaft, jaws, & nut.
2.Drill 3/16" holes.
3.Rivet 3/16" pins.
4.Assemble screw & rivet 1/8" pin.
5.Rough grind. 6.Buff.
7.Plate. 8.Ship.

STOCK RECORD
A1519

DATE	WORK TICKET	NO. PCS	TOT.	BAL.	THROUGH OPERATION 1	2	3	4	5	6	7	8	SCRAP	SALVAGE	INV. CON.
			7882	0	988	274	683	242	1478	619	0	3019	0	414	165
7-15	F.S.S.	127	8009	127											
	1903	127		0	1115										
	1902	35			1080	309									
	1904	173			907	482									
	1905	125				357	808								
	1906	125					683	365						416	
7-16	1931	15			892	372									
7-19	F.S.S.	125	8134	125											
	1935	125		0	1017										
	1936	155			862	527									
	1937	125				402	808								
	1938	100					708	462						419	
7-20	F.S.S.	119	8253	119											
	1961	119		0	981										
	1962	54			927	456									
	1963	125				331	833								
	1964	102					731	558						425	
7-20	INVENTORY				914	341	851	570	1477	653			0	420	8

FIG. 4.

minute dial. When the job is completed the ticket is rung out by again being placed in the clock and stamped with the arrow at the left and center.

Figure 3 shows that Mr. Kolb, whose number is 6, started to cyanide piece number 152Q, operations 3 and 4 at 5 minutes past one. When finished it was rung out, lapsed time being indicated by the arrows on the left-hand and center dials, showing 2 hours no minutes, 368 pieces finished, all accepted. The tickets are later transferred to the inspection bench where they are checked and posted in the stock records under job number 23 on Appendix B. A duplicate yellow work ticket is made out for each of the originals but not numbered serially. These are retained by the students while working, for their information. For other than production work only a yellow ticket is issued.

Figure 4 shows a characteristic sheet of the stock record book. Each component part and sub-assembly has a sheet similar to this which gives all information regarding that part, such as the "total" number of pieces supplied to date, the "balance," or number on hand ready for the first operation, the number through each operation, the number permanently scrapped, the number in salvage to be reclaimed or scrapped, and the inventory correction which represents losses, errors, etc.

A "finished stock storage" sheet lists all parts and sub-assemblies which make up the final assembly. On this sheet is shown the total number of each part put into the finished stock storage since the beginning of the contract which corresponds with the figure through the last operation on "component part" or "sub-assembly" sheet, and the balance of parts on hand which are ready for the final assembly.

After posting the work tickets of a previous laboratory period on the stock records, the student makes up a production report which guides the production in the laboratory for the following day. This report is made from the stock records and covers the condition of stock on the "assembly" sheet, "finished stock storage" sheet and "component parts" sheet,

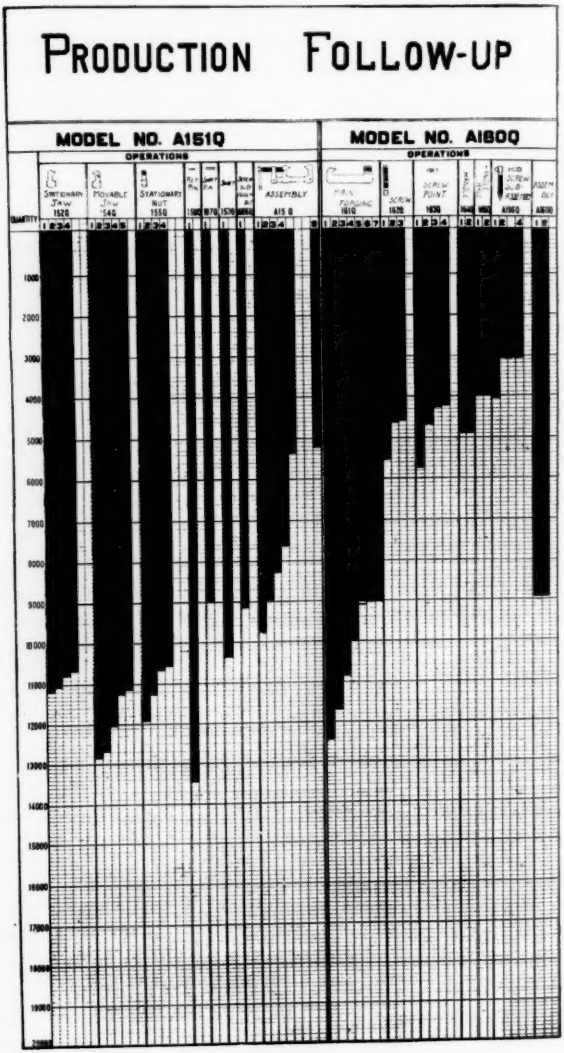

PRODUCTION FOLLOW-UP
MODEL NO. A1510
MODEL NO. A1800
OPERATIONS
OPERATIONS
QUANTITY
ASSEMBLY
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
15000
16000
17000
18000
19000
20000

FIG. 5.

as to number shipped, low and high points of production, etc.

Each month the production follow-up chart, Fig. 5, is brought up to date. This shows the number of parts put through each of its various operations. The purpose of this chart is to illustrate the usefulness of graphically representing facts and also to bring out at a glance unbalanced points of production. A production score board is also kept which shows the production for each period of twelve of the major operations. All productions below the standard are listed in red, while those equal or above are shown in white crayon. The purpose of this chart is to bring out the low points and irregularities of daily production.

Time study sheets are made in the laboratory. After being standardized the operation is divided into its elements and times taken of each element. When a sufficient number of observations have been taken to insure average conditions these results are averaged and the minimum and average times for the job determined. To the average time is added allowance covering fatigue, personal and other regularly recurring delays, which gives the standard time or commercial time for the job. The standard time is expressed in the number of hours required to produce one piece and the number of pieces produced per hour. This figure represents the normal production and may be used as a basis of setting piece rates, etc.

This scheme of quantity production is now in its third semester. The mechanical features of the course have settled down approximately to a final condition. Considerable work is yet necessary in developing the course academically, tying up the laboratory work with the classroom work.

Appendix A.

I. *The Scope of Shop Work in Engineering Education: Industrial Organization.*

History of production engineering—present need of trained men in production—types of organization, specialist—type best adapted to production—quantity production in the ma-

chine shop laboratory—production engineering in other schools—standard exercise work and its object—machines, tool crib and shop layout.

II. *Accounting and Stock Records.*

(*a*) Accounting:

The accounting department—the costs department—importance and purpose of general and costs accounting—labor, direct and indirect—costs, labor, material, overhead—administrative and selling expenses—list and selling prices—labor turn over—statistics and graphics.

(*b*) Stock Records:

The work ticket—its relation to labor payroll, stock records, time keeping—counters—the work ticket as applied to spring spreader production—stock records—stock records as applied to spring spreader production.

III. *Standardization: Time Study.*

Application of standardization as affecting machines, tools, material and labor—time study—its use—methods of taking time study—the human element—allowances—types of time studies—the standard time.

IV. *Wage Payment Plans: Incentives.*

Definition of wage payment plans—the parties interested—fundamental methods of paying labor—need of incentives—principles underlying incentive—objects of incentive—individual and group incentive—outline, definition and illustrations of various wage incentive plans.

V. *The Cutting of Metals (Lathe).*

Definition—research work—form of chip and cutting action—forces acting on a tool—clearance and rake angles—carbon steels—high speed steels—cutting metals with carbon

and high speed steels, considering angles, speeds, feeds and lubricants—stellite—lathes, engine and turret—boring and boring mills—special tools and accessories.

VI. *The Cutting of Metals (Milling).*

Definition and description of milling—economic advantages—types of machines—attachments—cutters, types and purposes—cutting action of a single tooth—various features of a cutter—principles underlying tooth spacing—fallacy of high powered cutters—research work—strength and shape of teeth.

VII. *The Cutting of Metals (Drilling, Reaming, Tapping and Broaching).*

(*a*) Definition and description of drilling—types of drills—best helix, clearance, point and other angles—flutes—torque and thrust—grinding and grinders—speeds and feeds—steels for carbon and high speed drills—lubricants—multiple fluted drills and reamers—reaming—tapping—types of drilling machines and accessories.

(*b*) Definition and description of broaching—types of broaches, tooth angles—speeds and cuts per tooth—broaching machines—possibilities.

VIII. *The Cutting of Metals (Grinding, Buffing, and Lapping).*

Definition of grinding—history—natural and artificial abrasives—properties of abrasives—making wheels—grit sizes—types of bonds—selection of wheels and their characteristics—theory of grinding—precision grinding and machines—cylindrical grinding machines—internal grinding—surface grinding—tool and cutter grinding—ordering wheels—handling and storage of wheels—safety—buffing—lapping.

IX. *Gears, Gear-Cutting and Gear-Cutting Machines.*

Forms of gear teeth—types of gearing—circular and diametral pitch—methods of cutting gears and worms—form cutters—generating—hobbing—thread milling of worms—gear-cutting machines—grinding gears—gear inspection.

X. *Jigs, Fixtures and Special Tools.*

Use of jigs and fixtures—simplest type of jig—drill jigs—milling and faceplate fixtures—special cutters—design of jigs—operation—locating points—varying degrees of elaboration in "tooling up"—features influencing tooling up policy—tool design and tool rooms for manufacturing organizations.

XI. *Standards, Measuring Instruments and Gauges.*

Quantity production—interchangeability—accuracy, new epoch opened by use of light interference methods—necessity of standards—commercial standards—Johannson and Hoke gauges—definition, object and types of measuring instruments—tolerances—the "limit" conception—development of gauges from measuring instruments—types of gauges, production, inspection and check gauges—construction, maintenance and cost.

XII. *Example of a Manufacturing Layout for an Article.*

Drawings—experiments—classification list—purchased and manufactured parts—proposals—sub-divisions of manufactured parts into castings, forgings, stampings and bar stock types—ordering and fixing delivery dates for all material—decisions on machining methods—selecting machine tools, etc.—routings and standard instruction sheets—design and construction of jigs, fixtures, gauges, etc.—demonstration of operations and time study—inspection.

XIII. *Automatic Machines.*

Definition—purpose—evolution—fields—fixed and indexing tools—fixed and indexing work—single and multiple spindle automatics, general, gear cutters, bar stock and chucking—accuracy of work—their effect on labor costs—examples of work done, tools, speeds, feeds and times.

XIV. *Die-Casting.*

Definition—newness of the art—development—obstacles, melting points and weights of casting—accuracy—cheapening of machining—types of machines—operation—construction of dies—material of dies—limitation of material now used for product—present trend of change in the art—recent examples—probable future developments—potential encroachment on the machining field.

XV. *Punch and Die Work; Spinning.*

Definition of die work—scope of work covered—parts which make up a punch and die—material used—clearance between punch and die—hardening punch and die—various applications, various types of presses and classification—lubricants—future field for punch and die work based on economy and development.

APPENDIX B.

Outline of Machine Shop Laboratory Work.

Giving: Job number, operation, machine, jigs and gauges.

1. Drill and ream .560 in. hole, LeBlond rapid production turret lathe, formed chucking jaws, two sets of drills and reamers in turret, limit plug gauges.
2. Mill point, Kempsmith hand miller, milling fixture, formed cutters.
3. Drill and ream .570 in. hole, LeBlond rapid produc-

tion turret lathe, formed chucking jaws, plug limit gauge.

4. Drill ⅛ in. and $^{11}/_{32}$ in. holes, Henry & Wright gang two spindle sensitive drill press, box jig, depth gauge.
5. Drill and ream .560 in. hole, No. 2 Bardons & Oliver turret lathe, formed jaws, three sets of drills and reamers in turret, plug limit gauge.
6. Drill $^{23}/_{64}$ in. and $^{9}/_{32}$ in. hole, Sensitive drill (U. of M.), two separate drill jigs.
7. Tap $^{7}/_{16}$ in. U. S. S. and ½ in. S. A. E. American radial drill, two separate tapping fixtures, threaded plug gauges.
8. (*a*) Mill point, Hill Clark & Co. hand miller, formed cutters, milling fixtures.
   (*b*) Drill $^{7}/_{16}$ in. hole, Snyder upright drill press, drill jig.
9. (*a*) Rough grind, grinding stand (U. of M.).
   (*b*) Buff, buffing stand (U. of M.), holding fixture.
10. (*a*) Standard Exercise, or
    (*b*) Cyaniding, Standard Fuel Engineering Co. Furnace, baskets, tongs, etc.
11. (*a*) Cyaniding, Standard Fuel Engineering Co. Furnace or
    (*b*) Standard Exercise.
12. Automatic screw machine, Acme multiple spindle, micrometers, depth gauges, etc.
13. (*a*) Retap ½ in. S. A. E. thread, bench machine, holding fixture, thread gauge.
    (*b*) Assembly, bench retapping machine.
14. (*a*) Milling, Milwaukee plain miller No. 3B, fixture for 12 pieces and formed cutters.
    (*b*) Assembly, Rochester high speed belt hammer.
15. Assembly, mandrel press.
16. Drill two $^{3}/_{32}$ in. holes, Avey drill press, drill jig.
17. (*a*) Trimming and forming, lathe with form tools.
    (*b*) Assembly and riveting.
18. Gauging, assembly and riveting, alignment gauge.

19. Threading and rolling, Jones & Lamson flat turret lathe, collapsible die, thread gauge.
20. Utility man, any emergency job.
21. Inspector of all jobs in shop.
22. Time study work, mounted stop watch.
23. Stock records and production reports.
24–30. Tool work or standard exercise work.

Note: The standard exercise work consists of a number of standardized machining jobs such as turning and boring, cutting tapers, threads, test pieces, gears, profiling, etc., involving the use of lathes, drill presses, shapers, planers, milling machines, broaches, profilers, etc.

THE ENGLISH DEPARTMENT.

The English Conference at Urbana last June left all of us who were there with a strong desire to extend, if possible, in some efficient way the opportunity which it afforded not only for personal contact but for the exchange of ideas regarding our mutual problems. A longer, more enthusiastic, more representative conference at Cornell next June was a foregone conclusion; but Cornell and next June seemed somehow very remote. We all wished for something more immediate that should make it possible to carry on and make continuous the effect of these two days together. The English Committee was directed, in fact, as one of its first tasks, to devise ways and means for bringing our instructors in English into closer relationship. It was agreed that much could be done, to this end, by continuing the correspondence between the Committee and the individual instructors, but something broader in its influence and effect seemed also desirable.

The English Committee is, therefore, pleased to announce that through the courtesy of the Editor of the BULLETIN, it is to have each month its own department in the BULLETIN, devoted to the exchange of ideas regarding the teaching of English to engineering students. The Committee regards this as an opportunity and a challenge and solicits suggestions from all interested as to how these two pages may each month be of the largest possible service in raising standards of teaching and in solving problems that confront the instructor or the administrative head who is ambitious for better results. Address at once all such suggestions to the Chairman of the Committee, J. Raleigh Nelson, 927 Forest Ave., Ann Arbor, Michigan.

Inasmuch as committee reports are apt to be lost in the mass of material printed in the *Proceedings*, and inasmuch

as our space is too limited to allow an extended report of the Conference at Urbana, we print below the report of the English Committee as presented to the general session last June.

Report of the English Committee.

The English conference at Urbana, the first of its kind to have been held in connection with the annual meeting of the Society for the Promotion of Engineering Education, was called with a two-fold purpose. It was hoped, in the first place, that it might afford the teachers of English to engineering and technical students the opportunity to meet and exchange views upon the problems of their work; it was also hoped that such a discussion might enlist the interest of other engineering educators alive to the vital place of English training in the preparation of engineering students. The results of the two conferences seem amply to justify the hopes of the Committee. There were present at each of the sessions about thirty representatives of twenty different schools, ranging all the way from the University of Maine to the University of Oregon. In addition to this, letters expressing interest and requesting reports of the conference were received from sixteen other schools, so that in all thirty-nine schools may be fairly said to have been brought within the influence of the conference. It was an especial object of gratification to the Committee that not only were there present a considerable number of representative English teachers, but that nearly one half of the conference consisted of deans, heads of technical departments, and teachers of engineering subjects.

The first session was devoted to an informal canvass of the status of English teaching in the schools represented; the second, to the discussion of the problem of a more perfect correlation of the English courses with the technical courses in the engineering curriculum.

The conclusions of the discussion may be summarized briefly as follows:

1. Our objective is identical with that of all teachers of English, *i.e.*, to develop the student's ability to express himself both orally and in writing with simple effectiveness; to enlarge his fund of ideas, and to increase his ability to classify those ideas; and finally, to create a sincere taste for discriminate reading and to develop standards of critical judgment.

2. Our method of approach must be to begin from and build on the professional interest of the student.

3. Our method of procedure must be to establish at all points the closest possible interrelationship between the instruction in English and that in professional subjects.

The notable features of the conference were, the honest desire of both English and engineering teachers to coöperate for more effective training in English, and the earnest purpose to develop a more intelligent correlation of English with the work in the technical courses.

The English Committee was directed to devise ways and means for bringing into closer relation the instructors in English in our engineering colleges, and to establish closer coöperation between the English departments and the departments of technical instruction, and to report at the English Conference to be held in connection with the next annual meeting of the Society for the Promotion of Engineering Education.

Respectfully submitted,

J. RALEIGH NELSON, *Chairman*,
FRANK E. SEAVEY,
W. OTTO BIRK,
SADA A. HARBARGER.

June 29, 1922.

The committee for 1922–23 is the same with the addition of Professor Karl O. Thompson, of Case School of Applied Science.

MORE ABSTRACTS FROM LETTERS RECEIVED FROM DEANS AND PRESIDENTS OF ENGINEERING SCHOOLS.

F. E. TURNEAURE, Dean, College of Mechanics and Engineering, University of Wisconsin, Madison, Wis.

"It seems to me that, broadly speaking, the most important problem before the engineering schools is the old one; what are the requirements which should be met by the engineering school, and how should the curriculum, teaching staff, etc., be organized to meet these requirements? In suggesting this fundamental problem, I am of the opinion that it has never been adequately studied, and that a properly constituted Board can do a great deal to crystallize opinion in regard to this very fundamental problem. Perhaps a statement of some of my own notions will explain what I have in mind as to past defects and future possibilities.

"First,—in regard to requirements of the present day in the matter of the school training of engineers: In attempting to answer this question, a great many fields of engineering activity should be considered. The question cannot be answered by the broad statement that engineers should be trained like lawyers or doctors and that engineering, being a profession, the training should preferably consist of general college courses followed by professional courses requiring altogether six or seven years. I think a certain class of engineers and educators is inclined to consider that this is the ultimate and inevitably correct solution. There are, on the other hand, a good many teachers and also engineers who consider that for many lines of practice, a four-year school period is long enough, and that the young man will do better to get into practical work than to remain longer in college. I have myself seen considerable evidence of the truth of the latter position. It is my belief that the technical requirements of an engineer and an engineering education vary over a comparatively wide range, and that a careful study of the situation with especial reference to this point will give us some really useful information.

"I think this problem can be divided into two parts: (*a*) how much general education should an engineer have, and (*b*) how much technical education should he have? In attempting to answer these questions, all branches of engineering practice should be thoroughly studied, and very definite inquiries should be made of men in practice who understand exactly what is wanted. The actual needs of men in various lines of engineering activity should be considered. Highly technical specialities should be recognized as such, and the proportion of engineers in various kinds of work should be information of significance in this connection.

"As an illustration of what I have in mind, consider the practice of highway engineering at the present time. A very large number of men are required at this work, and a large percentage of these men are not engaged (at least for many years), in a kind of work which involves a very large amount of technical schooling. The work of the young engineer, from the technical standpoint, is quite simple, and likely to be so for many years, —in fact, the business phase of the work is perhaps of more importance than the engineering phase, especially for men in the more responsible positions. It is true, also, that for certain classes of work, an engineer should have a very thorough training in structural design or in bituminous pavements, geology, etc., but the number of men needed for this kind of work is comparatively small, and some of this highly specialized work may well be considered in the category of specialization.

"Then there are many other varieties of engineers whose preparation does not need to be highly technical, such as the operating engineers, contracting engineers, and, in a sense, railroad engineers. In the various industries there are certainly many lines of work where the technical requirements are not high, but where business sense and judgment count more. I believe an effort should be made to analyze requirements very thoroughly along some such line as above suggested.

"It is my belief that the time has arrived when it may be expected that any young man desiring to enter any engineering employment, however simple, ought to secure, if possible, a college training of four years in length. With the tremendous increase in the high-school and college attendance throughout the country, and the

increasing ease with which young people can secure a college education, I believe that such an education should be required of any young man who goes into a business or profession where he expects, sooner or later, to exert considerable influence with his colleagues or with the public. A college education no longer is an uncommon thing. I am impressed with that fact in looking over our recently published Alumni Directory and noting the large number of university graduates located in all the smaller cities and many of the villages throughout the state. This number is bound to increase, and an engineering representative of the highway commission in any neighborhood, or the village or city engineer, should be a man who can acquire a standing with the best in the community. It is my belief, therefore, that a four-year college course of some kind should be the minimum set before the young man as a preparation for any line of engineering.

"It is quite true that the technical requirements of some lines of work may be met by means of short courses of two or three years in length, and that question was discussed by our faculty some years ago. We reached the conclusion that two-year courses would well satisfy the technical requirements for quite a variety of employment, but did not consider it the function of the University to establish such courses.

"If it is decided that a four-year college course is sufficient to meet the requirements for general education plus minimum technical requirements, then the problem resolves itself into that of determining the higher technical requirements and how they are to be met in the school: whether by a combination liberal arts course plus graduate work in engineering, or by a five- or six-year combination course carrying some engineering work throughout the period. At present our standard four-year engineering course as given in most schools is, in my judgment, of a quality which is neither hay nor grass: it cannot be considered a course for a broad education, neither can it be considered a very satisfactory course for those desiring the most advanced training. The first-named objection is more serious than the latter, because a student desiring advanced technical work can get it in graduate study; but the lack of breadth cannot be so easily remedied by the individual student.

"To indicate more clearly what I have in mind as to the direction for this phase of the investigation, I might outline what seems to me to be a fairly good solution, and the reasons therefor.

"In brief, this would consider a four-year engineering course (or pre-engineering course) which would be very general in its character. It would contain a large amount of work of general educational value, such as history, economics, language, science, chemistry, physics, mathematics and mechanics, also the elements in applied work in the usual branches of engineering. Such a course I would consider the minimum requirement for any young man who desires to enter the industries or any field of engineering whatever; and for many lines of work it would be a satisfactory preparation. It would also furnish a sufficient foundation in mathematics and science to enable a man of real ability to advance himself in almost any line of engineering activity, even where a longer course of training would be preferable. By the elimination or postponment of a very considerable amount of technical studies now included in the regular four-year course, such a course as above indicated could be made quite satisfactory from the standpoint of general education, and, on the whole, much more satisfactory than a four-year course in a college of liberal arts such as would be elected by students planning on an engineering course later. At least it would meet the needs of a great many more students, and I am inclined to think that it would be the best course for practically all.

"The four-year course as above indicated should lead to a degree (such as the B.S. degree), without special designation. Then those students who desire a more thorough engineering education should secure it by further study, either in the form of graduate work or fifth- and sixth-year courses leading to an appropriate second degree. These advanced courses would be well organized, and would be taken by a very considerable number of students, as they would contain a good share of the material now included in our senior year. They would naturally be taken by all students desiring to enter the research field and those aiming to become fairly well posted in any special line. I should suppose that from 25 per cent. to 40 per cent. of those finishing the four-

year course would continue for a fifth or sixth year, the percentage depending, of course, quite largely upon the curriculum adopted.

"Among the advantages of such a scheme as above suggested are possibly the following:

"1. It requires all engineering students to secure a much broader general education than is now the case, while at the same time it includes a sufficient amount of fundamental technical work to satisfy the requirements in many cases.

"2. It furnishes the well-organized technical work for special and advanced students which will encourage students of ability to thoroughly prepare themselves for research and special work of various kinds. Graduate courses in engineering will be much better organized than is now the case.

"3. It is a better arrangement than that frequently proposed of requiring a two- or three- or four-year college course before admission to the engineering school. In any pre-engineering course, a considerable amount of mathematics and science must be required in order to save time, and pre-engineering courses under the control and advice of the engineering faculty can be better adjusted to the students' need than when otherwise administered.

"4. It would, I believe, solve the problem of the four-year course, against which so much criticism is directed.

"5. It would tend to eliminate from the more advanced and technical work students who are unfitted for such work while at the same time capable of becoming successful engineers in certain lines of employment. With the very great numbers now attending engineering schools, a relief of work in the senior and junior laboratories would be very acceptable in most cases.

"There are, of course, many other phases of this study which any Committee will find it desirable to undertake, but I believe the very first thing to be done is to determine upon some reasonable solution of the problems above discussed. Engineering faculties are, I feel sure, quite capable of determining upon details and methods of teaching. They are also, in most cases, in very close touch with practicing engineers among their alumni and include among their members many men with considerable engineering practice. I do not believe, therefore,

that it is necessary to go far into details. On the other hand it is true that engineering teachers are, as a whole, quite concerned over the situation, and are prepared to follow the lead of a strong report which will clearly set forth requirements and a way to meet them under the conditions actually existing in the majority of engineering schools. The meetings held last spring and summer of a number of the engineering deans in this part of the country are quite significant, and I presume you are familiar with the action they took. It is in the precise direction as indicated in the above discussion. We, I think, are ready to move, but we want to move in reasonable unison, and in a direction that it will not be necessary to retrace in the near future."

HUGH MILLER, Acting Dean, George Washington University, Washington, D. C.

"First: The important things to be done are, in my opinion:—(*a*) to liberalize the curriculum probably to the extent of making the first degree B.S. in Engineering instead of B.S. in the several branches, (*b*) to raise the standard of teaching by better selection and training of teachers, (*c*) to coöperate with industry by means of research work, consulting work by older members of faculties, and part-time employment of students.

Second: With regard to what we are doing here might say that we are trying to liberalize the curriculum, adding post-graduate courses in engineering, and raising salaries of engineering teachers so as to attract better men.

"Third: We hope in the future to increase our laboratory facilities so as to provide for research work."

P. F. WALKER, Dean, School of Engineering, The University of Kansas, Lawrence, Kansas.

1. "What are the really important things to be done and what is the best method of procedure?

"In answering this I may indicate some of our attempts which pertain in part to the second question. We are trying to give to students a broader view of industrial activities. It is my belief that we need to bring more of the spirit of sound industrial enterprise into our teaching. Our students tend to become crammed with a species of book wisdom that prevents the active use of their own minds and takes them out of the at-

mosphere of business. They become fearful of exercising their own judgment.

"The remedy is not found by putting them into classes of various kinds, cultural or otherwise. It will be found by the filling of the teaching staff with the spirit and ambition to truly teach men the methods of directing energies of nature through the organized activities which are typical of the industrial work.

2. "To what features of the general problem has your school been giving special attention?

"To accomplish the point last mentioned, we at Kansas are establishing contacts through the investigation and conferences with:

> "Chambers of Commerce of all of the leading cities of the state in connection with a study of industrial conditions.
>
> "Manufacturers, especially those in the line of machine-shop products and Portland cement, who are in this state and nearby districts through conferences on the training of men into meeting their needs and by arranging with them for summer vacation work for students.
>
> "Superintendents and operators of municipal plants, and city commissioners in charge of utilities, by conferences, and short "schools" for the discussion of sanitation and sanitary engineering problems.
>
> "Public electric utility men, by collaborating on power transmission data and joining in their conferences. Students every year gain contact by running tests on certain plants."

3. "What may it in the future plan both for itself and as a contribution to the general movement?

"For the future, to continue the activities mentioned with developments as conditions dictate. No special plans have been made to extend beyond the local field. It is my thought that if members in a large number of institutions were to carry through such a program in their respective districts, there would be accumulated gradually a mass of material that would be of use in a general way. A collaboration of the results and findings of the scattered groups might then yield much of value."

WILLIAM E. MOTT, Director, Carnegie Institute of Technology, Pittsburgh.

"Our faculty has this matter (opportunities to cooperate with industries in our educational work) under consideration and I write at this time to make but one suggestion. There have come to my desk from time to time during the past year letters from various organizations in which they express a desire to coöperate with engineering schools. I have in mind at this moment a letter from the Secretary of the American Railway Association which Association is planning to appoint a "Special Committee on Coöperative Relations with Universities."

"Professor Wickenden of the American Telephone and Telegraph Company has written also, asking for comments with reference to the work of the National Personnel Association and certain suggestions made by their Standing Committee on Relations with Engineering Schools. Is it not possible that the work of these outside organizations may best be correlated with that of the engineering schools through your newly organized Board of Investigation and Coördination?

"Doubtless this thought has already come to you or to the members of your committee and it seems to me that a great deal of saving in time and effort will be brought about if institutions like our own may deal with one organization rather than prepare data for and carry on correspondence with a variety of educational committees.

"I take this opportunity to assure you that the members of our engineering faculty are deeply interested in your new plans and we shall do our best to coöperate with you."

E. H. WELLS, President, New Mexico School of Mines, Socorro, N. M.

"I assure you that I am very much interested in the work which the Society is doing and would like very much for this school to become an institutional member of the society."

A. N. JOHNSON, Dean, Engineering College, University of Maryland, College Park, Md.

"I would call attention to the work of the Committee

of the American Association of Engineers, of which Mr. McDaniel is chairman, which is undertaking an analysis of engineering requirements. The field to be covered will be highway engineering and railroad engineering. There are being prepared circulars which will be sent out requesting certain information. On Mr. McDaniel's committee is Dr. Mann. These men are working in very close coöperation and I believe that something very much worthwhile will be developed. We might, with mutual benefit, arrange for some coöperative work between committees of the A.A.E. and the S.P.E.E."

FRANK D. ADAMS, Dean, McGill University, Montreal.

"The staff of the Faculty of Applied Science at McGill University is greatly interested in the recent trend of thought with reference to training in Engineering. It has long recognized that broad culture and the development of manly character are at least as important in the training of engineers as work in strictly technical subjects.

"With reference to the best method of developing a manly character I may say that we place reliance more particularly in the general spirit and character of the instruction given and of the University atmosphere, as well as on the personal relations which students cultivate among themselves and the encouragement of worthy student activities."

C. E. CLEWELL, Dean (pro tem), Towne Scientific School, University of Pennsylvania, Philadelphia, Pa.

"I have taken the matter up with our Engineering Departments, and as a result of such conference, give you herewith the following points.

1. "Some basis of differentiating between
   (*a*) A broad, liberal fundamental education for students of engineering who are qualified through natural ability and personal characteristics to get the largest possible return from a high-grade university course of this character, and
   (*b*) The more restricted and specialized course in Engineering, now generally offered by the technical schools of the country.

2. "Determination of some educational basis that will enable technical schools and colleges to properly meet the demands for technical training and education and at the same time to differentiate the classes of young men who are seeking some form of technical education, so that no single group or class will be seriously handicapped in its work and progress by the overcrowding of the various schools and colleges with material of an inferior grade.
3. "Assist in determining some definite basis of selection of students peculiarly qualified for the type of course outlined in 1 (*a*).
4. "Coöperation with the Universities in securing better qualified educators for our technical schools and colleges.
5. "It was the feeling of those in the conference that there should be fostered in the leading universities and technical schools of the country a keener interest in high-grade research."

COLLEGE NOTES.

Municipal University of Akron.—The Board of Trustees at their meeting on October 11 decided to take steps directed toward remedying the overcrowded conditions now existing in all departments. Efforts will be made to secure state legislative action which will allow Akron taxpayers to vote upon a bond issue for buildings or an increased tax rate to run for a definite period, the proceeds to be used for buildings and equipment.

The enrollment has increased since 1914 when the institution became a Municipal University from 198 to 865. During that time a library and an engineering building have been added. Attendance next year will probably be limited to the present enrollment.

University of Arizona.—The College of Mines and Engineering opened its year's work with an enrollment over 15 per cent. greater than last year. The engineering students have come to the University from 35 states and six foreign countries, over 35 per cent. of the enrollment being from states outside of Arizona. The only change made in the Faculty was the addition of V. L. Ayres, formerly of Pennsylvania State College and Case School of Applied Science, as an instructor in Geology and Mineralogy. A large amount of equipment was purchased during the past summer, and most of it has been set up and is now in use. Steel towers for use by the Electrical Engineering Department in connection with an elaborate radio installation have been ordered from the east. They will give an average antenna height of 125 feet, and the University expects once or twice a week to broadcast programs to Arizona high schools during their Assembly periods. It is believed that the close connection between the University and the high schools thus established will prove decidedly beneficial.

Dr. C. H. Marvin, who was elected late in the summer to be President of the University, has taken up his duties with great vigor, and has instituted a program of development that will undoubtedly mean much to the institution. He has expressed the determination to obtain the best and most complete equipment in Metallurgy, Ore Dressing, Mining, and Geology available anywhere in the country, and has secured the adoption of such a salary schedule as will make it possible to bring well-known specialists in these subjects to the University. The work of the other engineering departments, since it is recognized they contribute materially to the advancement of the mineral industries, will not be slighted; and a decided effort will be made to attract more graduate students in the subjects mentioned.

California Institute of Technology.—A high-voltage testing transformer is being built by the Westinghouse E. & M. Company for installation in the new high-voltage testing laboratory now under construction. A potential of 1,000,000 volts to ground will be produced by this equipment, its capacity being 1,000 kva. or 1,340 hp. at this extremely high voltage. The apparatus will consist of four special 250-kva., 250,000-volt testing transformers connected together so that their individual voltages will be added. Each of the four testing transformers weighs approximately 23 tons when filled with oil, has a diameter of about 8½ feet and an overall height of approximately 20 feet.

In addition to the testing transformers, two 550-kva. regulating transformers and their induction regulators will be furnished, these weighing approximately 8 tons.

Arrangements are being made to control the testing transformers individually and also as a 1,000,000-volt transformer from several different control stations located at different points in the new laboratory, so it can be readily seen that the control system alone will require the use of considerable equipment connected by a maze of wires. A considerable portion

of this control equipment will be automatically operated and controlled by push buttons.

It is interesting to note that a potential of 1,000,000 volts between terminals one meter in diameter will cause a spark to flash across an air gap of approximately 45 inches and, when between needle points, it will jump an air gap of from 12 to 15 feet.

This equipment will be in charge of Dr. R. A. Millikin, assisted by C. E. Darwin, H. A. Lorentz, R. W. Sorensen, and other members of the Faculty and also by several engineers of the Southern California Edison Company.

University of Cincinnati.—The Engineering College started the year with almost exactly a thousand students. One or two very slight changes have been made in the details of operation of the coöperative course. For instance, the first- and second-year students alternate on the bi-weekly basis, while the third-, fourth- and fifth-year students alternate on the four-weekly basis. Third-, fourth- and fifth-year students are required to report to their jobs the Saturday preceding their regular period of practical experience, in order that they may go over the work with their alternates. So many of the students are holding jobs of appreciable responsibility that it was necessary in their cases to have this contact.

Two new developments of some importance have taken place. A new professional school for women has been organized by Dean Schneider, and is under his direction. In this professional school for women, the first two years will be spent in full-time attendance at the University, and the third, fourth and fifth years will be on the coöperative basis.

A new school in architecture is being organized and this year some first- and second-year students were registered. This school, of course, will be on the coöperative basis.

George Washington University.—An advanced course in Reinforced Concrete Construction is being given this year

under the direction of Mr. O. H. Schroedl, Lehigh, 1911, who is connected with the Engineering Department of the Interstate Commerce Commission.

A course in Radio Principles and Practice is being given by Dr. T. B. Brown, of the Physics Department.

Hugh Miller, professor of Civil Engineering, has been appointed acting dean of engineering.

Georgia School of Technology.—On August 1st Dr. M. L. Brittain, formerly State Superintendent of Schools of Georgia, was inaugurated as President of the institution succeeding Dr. K. G. Matheson, resigned.

Prof. John L. Skinner has been elected head of the Department of Architecture succeeding Prof. F. P. Smith who resigned in June to become a member of the firm of Pringle and Smith, local architects.

Work is progressing rapidly on the new Physics Building, funds for which were in large part donated by the Carnegie Foundation.

The enrollment for the year is much greater than in any former year. There are over seventeen hundred engineering students and well over three thousand students in the whole school.

University of Illinois.—Milo Smith Ketchum has been appointed Dean of the College of Engineering and Director of the Engineering Experiment Station. Dean Ketchum graduated from the University of Illinois with a B.S. degree in 1895 and was granted the degree of C.E. by the same university in 1900.

The following appointments have been made:

Thomas Newkirk McVay, Instructor in Ceramic Engineering.

Clement Clarence Williams, Professor of Civil Engineering and Head of the Department.

Thomas Douglas Mylrea, Assistant Professor of Structural Engineering.

Jamison Vawter, Assistant Professor of Civil Engineering.

Albert Lyle Chavannes, Instructor in Electrical Engineering.
John Otto Krachenbuehl, Instructor in Electrical Engineering.
Luther Bunyan Archer, Assistant in Electrical Engineering.
Max Albert Faucett, Assistant in Electrical Engineering.
Henry Tregellas Bowman, Instructor in General Engineering Drawing.
Arnold Alinder Lundgren, Instructor in General Engineering Drawing.
Robert Edwin Kennedy, Superintendent of the Foundry Laboratory.
Howard Edward Degler, Instructor in Mechanical Engineering.
William N. Espy, Assistant in Mechanical Engineering.
Robert Frederick Paton, Associate in Physics.
Harold James McKeever, Research Graduate Assistant in Civil Engineering.
David Lewis Fiske, Research Graduate Assistant in Mechanical Engineering.
Louis William Huber, Research Graduate Assistant in Mining Engineering.

State University of Iowa.—Mr. E. L. Waterman, formerly with the Extension Division of the University, has been appointed Associate Professor of Sanitary Engineering, in place of Mr. John H. Dunlap, elected Secretary of the American Society of Civil Engineers. Mr. John P. Fielding has been appointed instructor in forging.

The faculty of this college, being in favor of a lengthened course in engineering, is encouraged to believe that the change could be made without serious difficulty by reason of the fact that twenty men have registered in the freshman class for the regular five-year course in Chemical Engineering, the only course in this field of this length in this part of the country.

In the Hydraulic Experimentation plant an elaborate series of experiments are being made, and are now nearly

completed, to determine comparative coefficients of flow through culverts of vitrified pipe and of corrugated iron pipe; also the effect of different forms of entrance ends.

These experiments are being conducted jointly by the U. S. Bureau of Public Roads, Department of Agriculture, and the College of Applied Science, Mr. D. L. Yarnall being in charge for the Government, and Mr. F. A. Nagler for the college. Pipes from 12 inches to 30 inches in diameter are being used in the tests, the whole volume of the flow of the Iowa river being available for this purpose.

Kansas State Agricultural College.—The registration of collegiate engineering students at Kansas State Agricultural College shows an increase this fall of about 50 over this time last fall. The last two years have shown a remarkable increase in the enrollment, especially in the three upper classes, in which we have had more than twice as many students as in the preceding two years.

The total number of students enrolled in collegiate engineering work here last year was 753, more than twice the number taking this work before the war.

University of Kansas.—H. A. Rice, formerly Professor of Mechanics and Structural Engineering, has been made Professor of Civil Engineering and the head of that department.

Frank L. Brown has been promoted from Associate Professor to Professor of Mechanics, and made the head of the Department of Mechanics.

F. A. Russell has been appointed Professor of Railway Engineering, and takes over the work in that branch carried formerly by Professor Williams.

F. M. Dawson has been appointed Associate Professor of Mechanics to take charge of the work in Hydraulics in place of Professor J. O. Jones, who has transferred to a corresponding position at the University of Minnesota.

A. M. Ockerblad, who has been Assistant Professor of Civil

Engineering, has been transferred to a corresponding position in the Department of Mechanics.

Harold L. Layman has been promoted from Instructor to Assistant Professor in Civil Engineering.

George W. Bradshaw has been appointed Instructor in Civil Engineering.

J. M. Kellogg has been appointed Professor of Architectural Design in the place made vacant by the resignation of Professor LaForce Bailey.

M. A. Abbott has been appointed Instructor in Architecture.

The new Electrical Engineering Laboratory is now in service. It forms a section of the general laboratory building 50′ x 110′ in floor dimension. A large portion has a second floor for the lighter work. New equipment is being installed at the present time.

Lafayette College.—Mr. Stanley R. Cummings, M.S., formerly a member of the faculty at Oregon State Agricultural College and at the Massachusetts Institute of Technology, is now an instructor in the Mechanical Engineering Department succeeding Mr. R. S. Wilber who has accepted a position at the Naval Academy.

Mr. G. G. Mercer, recently at Purdue University, has succeeded Mr. Price as an instructor in Electrical Engineering.

The enrollment in Engineering courses in the freshman class has increased from 83 last year to 117 in the class of 1926.

A student Radio Club has been formed with about 35 members. Two complete sets of good quality are operated by the club.

Student Branches of the Civil, Electrical, Mechanical, and Mining Engineering Societies are holding meetings regularly, and the Gayley Chemical Society, composed of students in chemistry and chemical engineering, has resumed sessions.

The course in Administrative Engineering, a variation of the Mechanical Engineering course with more emphasis on

production methods and economics and less on design, which was announced late in the spring, was inaugurated this fall with fourteen students in the first class. The course leads to the degree, B.S. in A.E.

It is expected that the coöperative work in local industries, which has been omitted on account of the industrial depression, will be started soon. A five-year course, three years of which are spent partly at college and partly in engineering work, leads to the degree of M.E.

Marquette University.—Mr. Stewart P. Scrimshaw has been appointed Professor of Industrial Relations as head of coördination department. Mr. Scrimshaw was for some time in charge of Apprentice work with the Wisconsin Industrial Commission, and later with Kearney Traecker Company as head of the industrial relations department. He spent the last summer in Europe studying their conditions. Mr. Jos. Gardner Bennet has been appointed Assistant Professor of Civil Engineering. Mr. Theodore Trams has been appointed Instructor in Civil Engineering. Mr. Bruce Greenshields has been appointed Instructor in Drawing and Civil Engineering. Mr. Greenshields was formerly with the A. T. & S. F. Railway.

The coöperative period has been extended from two to four weeks, which longer period seems in many respects to be more satisfactory all around than the two weeks period. Business subjects formerly being a part of the M.E. curriculum are now included in those of other courses as well.

The faculty has dispensed with about one half of its business meetings and has substituted therefor social gatherings to which the ladies are invited. This creates a very wholesome spirit of sociability and good friendship among the members and their wives. Occasionally the faculties of other colleges of the university are invited.

The enrollment this year is 339 as compared with 53 in 1917.

University of Nebraska.—Mr. Harvey S. Kinney is a new member of the instructional staff at the University of Nebraska. His work is in the Department of Applied Mechanics in classes in drafting.

Professor Wm. L. DeBaufre has been given permission to absent himself from the University to whatever extent may be necessary in order to proceed with his work as a member of the Helium Board. This board is operating under the Bureau of Mines, studying both methods and apparatus for the production of helium for use in the balloons of the Army and Navy Departments. Mr. Glenn Pickwell is assisting Professor DeBaufre both in these special investigations on helium and in his University work.

Newark Technical School.—Prof. V. T. Stewart of the Department of Chemistry has been appointed acting head of the Department.

Additions to the faculty have been appointed as follows:

J. A. Bradley, B.S., A.M., Harvard, Department of Chemistry.

F. N. Entwisle, B.S., Princeton, Department of Physics.

Bedross S. Koshkarian, A.B., A.M., Yale, Department of Mathematics.

A. A. Nims, B.S., Worchester Tech., Department of Electricity.

A. P. Roberts, M.E., Stevens Institute, Department of Mechanical Engineering.

The College of Engineering is installing a power plant to be used primarily for experimental purposes, but which will furnish light, power and heat for the Engineering Laboratory Building.

The unit will consist of boiler and accessories, engine, generator, superheater and condenser. The installation will furnish a problem for the senior mechanical and electrical students.

The coördination department has added to the list of cooperative concerns the McNab and Harlan Co., The Seaboard By-Product Coke Co., and The American Transformer Com-

pany, four men being placed in the first concern, and two in the other two.

Northeastern University School of Engineering.—It has been found necessary to limit the number of students that will be admitted to the freshman class. The maximum that will be admitted this year is four hundred (400). New appointments to the faculty have been made as follows:

Marius Rolland has been appointed assistant professor of Industrial Organization.

Ernest R. Kingsley has been appointed assistant professor of Electrical Engineering.

Milton J. Schlagenhauf has been appointed assistant professor of Social Sciences. Professor Schlagenhauf will devote his attention particularly to Sociology and Psychology.

The following have been appointed assistant instructors in the school: Ralph E. Brown, Edwards S. Parsons, Cameron S. Toole. Charles O. Baird, Jr., has also been appointed an assistant instructor.

Ohio State University.—On October 2, Ohio State University began the second quarter under the new plan of administration, known as the Four-Quarter Plan. While any new system, of course, presents its difficulties, the plan, as a whole seems to be considered a progressive move.

The total enrollment in the College of Engineering is 1,370, divided as follows:

Freshmen	312
Sophomores	519
Juniors	291
Seniors	248

The noticeable increase in the sophomore group, which is practically all electrical engineering, is interesting. While several suggestions have been offered, the reason for this increase does not now seem apparent.

The Engineering Survey for the incoming technical men, for which credit is given for the first time this year, is under

the direct supervision of Dean E. A. Hitchcock. The purpose of this survey is to inform the students of the broad and general aims of the engineering profession, the qualifications of the engineer and the various branches of engineering as well as to suggest to them desirable habits of study and the right attitude toward the engineering fundamentals.

Students now entering this college offer foreign language for entrance and are not required to take one in college. The number of hours of English has been increased to twelve. All freshmen engineers now have nine hours of required English instead of six under the previous plan. The advanced course on English for seniors (3 hours) has been made a required course for architectural, mining and civil engineers, and, where the schedule permits, is usually elected by the students from the other departments.

Mr. Herbert Baumer has been added to the teaching and University Architect's staff of the Department of Architecture, with the rank of Professor of Architecture. He is giving part of his time to instructing in Architectural Design classes, and part to assisting in the University Architect's office, in the design of new buildings and campus improvements for the University.

During *Management Week*, the College of Engineering united with the College of Commerce and Journalism for a one-day Student Congress on Management. The principal speakers were

John Younger, General Manager, Standard Welding Company; National Chairman, Management Week.
H. L. Kirker, Westinghouse Electric & Manufacturing Co.
L. W. Wallace, Executive Secretary, Federated American Engineering Societies.
Richard A. Feiss, Vice-President of Joseph & Feiss; President of the Taylor Society.

An exchange professorship has been arranged with the University of Iowa for the Department of Engineering Drawing; Professor F. G. Higbee, of the University of Iowa,

is to teach in the University from December 4 to December 20, and Professor O. E. Williams to teach at the University of Iowa during the same period.

Oregon Agricultural College, Department of Civil Engineering.—Mr. J. E. Fitzgerald, Jr., who graduated from this institution in Civil Engineering in June, 1922, has been appointed Instructor in Civil Engineering. Mr. Fitzgerald took the position left vacant by Mr. E. C. Matthews, who has entered the business field and is now connected with the National Biscuit Company at Grand Rapids, Michigan.

University of Pennsylvania Mechanical Engineering Department.—Additions and replacements have been made to the equipment in the experimental laboratories during the past two years to the amount of about forty thousand dollars. The apparatus includes a 100-hp., 250-lb. B & W. boiler (with an independently fired superheater); a 100-hp. Sprague electric dynamometer, several leading types of gasoline automobile and aëroplane engines and a 50-hp. uniflow engine of the vertical type.

An electric hardening furnace and electric drawing furnace have been installed as part of the Shop Laboratory equipment for the purpose of furthering the work in metal heat treatment. With these units are included recording pyrometers and an automatic regulating device for the drawing unit. Money is available for an outfit of oil furnaces for similar work. Also a Fellows gear shaper has been added and money is at hand for an electric melting furnace to be placed in the Foundry.

Mr. W. Chattin Wetherill and Mr. Lee N. Gulick have been advanced from the rank of Instructor to that of Assistant Professor effective on July 1, 1922.

Dr. R. H. Fernald, Director of the Mechanical Engineering Department, in addition to many other civic and technical activities, became President of the Engineers' Club of Philadelphia on July 1st. This is one of the largest engineering

organizations in the country, having in the neighborhood of 2,000 members and an additional affiliated membership of approximately 3,000.

John C. Green School of Engineering of Princeton University.—The enlarged School of Engineering of Princeton University offers courses in Civil Engineering, Electrical Engineering, Mechanical Engineering, Chemical Engineering and Mining Engineering. At the end of four years the degree of Bachelor of Science in Engineering will be conferred, and at the end of the fifth year the technical degrees in the first four of the courses will be offered. The aim of the courses is to utilize the facilities at Princeton University to give engineering courses in which fundamentals and cultural courses will be emphasized in the first four years. The work of the four years is to prepare graduates for entering into engineering with the proper training in fundamentals but with training in a number of engineering courses replaced by courses in economics, history, literature and science. The fifth year will include a number of the special courses found in the present four-year courses of many of our schools of engineering.

It is hoped that the training will produce engineers of broad viewpoint. The enlarged school has been in operation for one year in the first three courses, and this year freshmen are admitted to the courses in Chemical Engineering and Mining Engineering. The only addition to the faculty for this year has been that of Arthur M. Greene, Jr., who becomes Dean of the School and Professor of Mechanical Engineering. It is planned to enlarge the Faculty at the beginning of next year when new courses will be offered to juniors in Electrical and Mechanical Engineering.

Purdue University.—September thirteenth, Purdue University entered upon its forty-ninth year of activity under the leadership of the new president, Dr. E. C. Elliott. Doctor Elliott has now been with us less than two months, but in that time his personal touch has become so intimate with the faculty

and student body that his complete adoption as the leading member of our university community has been practically accomplished.

The institution began the year with about the same enrollment as that of last year, but with certain added facilities. The new Home Economics building, one of the most up-to-date buildings on the campus, is now occupied by that department, although some of the interior features are still unfinished. The new Recitation Building will probably be ready for occupancy about January first. When these two buildings are occupied to capacity they will relieve much of the congestion of the past few years. The Purdue Union building which was started in June is now above grade line and going rapidly. The corner-stone laying will take place on the occasion of the Annual Home Coming, November 25th.

One noticeable change in the financial policy of the institution this year is the creation of the position of Controller and the selection of Mr. W. T. Middlebrook to take charge of this work.

The first informal gathering of the entire engineering faculty will be a joint meeting with the instructional corps of the English department at a six o'clock dinner meeting, November first. Following the dinner the rest of the evening will be occupied in a discussion of Special Problems in Relation to the Teaching of English to Engineering Students.

Rhode Island State College.—Prof. Albion N. Doe, formerly of the University of Texas, has been engaged to take up work in the recently organized Department of Engineering Extension.

University of South Carolina.—Professor M. Goode Homes, C.E., for thirteen years with the Dept. of Civil Engineering, University of South Carolina, most of this time head of the Department, was shot and killed by a partially insane employee in the Treasurer's office of the University on Saturday, May 6. Thus the State of South Carolina lost one of its most

brilliant, loyal and constructive engineers and teachers. The Highway Department of the State owes much of its start and progress to his foresight and initiative. The University forged ahead partly as a result of his efforts in the Engineering Department.

Propessor Walter E. Rowe, who was the head of this department during the year Professor Homes was on military duty in Texas, 1917–18, has returned, being selected to fill Professor Homes' place. Prof. Rowe has an enviable record of achievement as teacher and engineer, especially on highway work.

Perry M. Teeple, Adjunct Professor, is now in his fifth year of service as assistant in the Department. During the past summer he has had twelve miles of top soil road construction under his charge.

The enrollment in the Department of Engineering is the same as last year, fifty at the end of September.

Stevens Institution of Technology.—The new and more exacting entrance requirements for Stevens went into effect this year with the result that the size of the Freshman class is materially reduced as compared with last year, there being 176 members now against 279 a year ago. The change in the entrance requirements consisted in the addition of a comprehensive examination in elementary and advanced mathematics for all students presenting a high school or preparatory school certificate. For a number of years the certificate only from an accredited school was required for admission. A further stiffening of the college requirements, which contributed to the reduced enrollment of the Freshman class, consisted in the faculty action which made it necessary that all students dropped from last year's Freshman class, should take all the entrance examinations before being permitted to repeat the year. The total college enrollment is a little over 600. The faculty changes include the appointment of Robert M. Anderson, M.E., as Professor of Mechanical Engineering, he having served as acting professor since the resignation of Prof. Pryor in 1919. This appointment is in addition to his position as

Professor of Engineering Practice which he has held for many years. Dr. George M. Weimar, who was awarded his Ph.D. by New York University in June, 1921, has been promoted to Assistant Professor in the Department of English and Logic, and Mr. W. M. Stempel, A.M., has been advanced from Instructor to Assistant Professor in Physics. Mr. Raymond P. Loughlin, M.E., who has had a wide experience in practical drafting-room work, has been appointed instructor in the Department of Machine Design to take the place of Mr. D. E. Davis, who resigned to accept a position in the Mechanical Engineering Dept. at Villa Nova College. Other new appointments on the teaching staff are: Albert J. Sieree, M.E., and Eugene Fezandie, M.E., in the Department of Mechanical Engineering; Wallace S. Fowler in the Department of Physics; Frederick J. Moller, M.E., in the Department of Machine Design; William E. Doyle, Jr., M.E., in the Department of Electrical Engineering.

L. C. Smith College of Applied Science, Syracuse University.—Mr. George S. Parker, formerly of the faculty of Columbia University and the University of Illinois, has been appointed Assistant Professor of Electrical Engineering.

Mr. H. R. Myers, a graduate of Queen's University, has been appointed Instructor in Civil Engineering and Drawing.

A. & M. College of Texas.—Effective with the beginning of the school year, J. C. Nagle resigned as Dean of the School of Engineering and Professor of Civil Engineering to devote his entire time to engineering work. He was succeeded as Dean of the School of Engineering by F. C. Bolton, Professor of Electrical Engineering, and by J. J. Richey as Professor of Civil Engineering.

In his capacity as Director of the Texas Engineering Experiment Station, Dean Nagle was succeeded by E. J. Fermier, Head of the Department of Mechanical Engineering, who has taken on the additional duties of Director of Texas Engineering Experiment Station.

COLLEGE NOTES.

Additions to the Teaching Staff.

Department of Architecture: Mr. Grayson Gill, Associate Professor.

Department of Civil Engineering: Mr. Williams L. Stanton, Associate Professor.

Department of Chemistry and Chemical Engineering: Mr. C. R. Voges, Mr. C. C. Bauer, Mr. Hendersee Hendrey, Mr. Errol Middleton.

Department of Electrical Engineering: Mr. Norman F. Rode.

Department of Mechanical Engineering: Mr. G. M. Lundberg, Instructor, A. V. Brewer, Assistant Professor.

The new Mechanical Engineering Shop Building has just been completed at the cost of about $175,000. It is a modern fireproof structure and will house the various shops in which engineering students receive instruction.

University of Utah.—Mr. Charles G. Maier, formerly in charge of the research laboratory of the Phelps Dodge Corporation of New York, was, in June, 1922, appointed assistant director of the Mining and Metallurgical Research Department. At the same time six fellows, representing as many universities of the country, were appointed to this Department. These men give all their time to research work.

The work of this Department is done in coöperation with the United States Bureau of Mines, several Bureau experts being assigned to the work here.

Mr. Ivan L. Anderson is the new research fellow in the Department of Mechanical Engineering.

The Board of Regents of the University, on the recommendation of the Engineering faculty, set aside the annual income of the James McGregor Fund to purchase additions to the library of the Engineering Experiment Station. This has already made available $15,000 for this purpose and the annual fund will hereafter amount to about $2,000. This money will be used to buy books and journals for this library.

The curricula of the Schools of Mines and Engineering were revised this spring to make room for more courses in Business and Economics. All seniors now take in common five hours through the year in these subjects. A new four-year curriculum in administrative and commercial engineering was also added.

Washington and Lee University.—A new and complete laboratory equipment for the testing of bituminous and non-bituminous road materials has been installed and will be ready for the highway class next semester and for seniors on thesis work.

SECTIONS AND BRANCHES.

On October 5, the Secretary sent a questionnaire to the Society's representative in each institution, asking for data so that an accurate list of Sections and Branches, together with the names of the officers of same, might be published in the December number of ENGINEERING EDUCATION. Up to November 15 the following replies had been received. The Secretary knows this list is not complete. If the name of your Section or Branch does not appear on this list, will you kindly send the information to the Secretary at once?

SECTIONS AND BRANCHES.

Name of Institution.	Section or Branch.	President.	Meetings Held During Year.	Secretary.
Case School of Applied Science	Branch	W. R. Veazey	3	To be appointed
Georgia School of Technology	Section	Floyd Field	At call of Chair.	John L. Daniel
University of Kansas, Kansas State Agri. College, University of Nebraska	Section	P. F. Walker, Univ. of Kansas	2	C. W. Smith, Univ. of Nebraska
University of Maine	Branch	H. W. Leavitt	10	W. B. Emerson
Marquette University (Planning a Section with University of Wisconsin)	Branch	J. C. Pinney		L. J. Mellencamp
New York University	Branch	W. R. Bryans		C. T. Schwarze
University of Akron	Branch	F. E. Ayer	10	R. C. Durst
Ohio State University	Branch	E. F. Coddington	4	To be elected
University of Pittsburgh, Carnegie Institute of Technology	Section	J. H. James, Carnegie Inst. of Tech.	2	L. C. McCandliss, Univ. of Pittsburgh
Stevens Institute of Technology	Branch	L. A. Hazeltine	10	F. C. Stockwell
A. & M. College of Texas	Branch	F. C. Bolton	10	F. E. Lichte
Tufts College	Branch	F. E. Seavey	2	
University of Vermont	Branch	J. W. Votey	10	Ed. Robinson
Yale University	Branch	To be elected	5	T. K. Hendrick
New England Section	Section	G. C. Anthony Tufts College	3	H. S. Boardman, Univ. of Maine

SECTION NOTES.

Kansas–Nebraska Section.—We are having a great revival in the interest of the S. P. E. E. Ten day ago we held in Manhattan the fall meeting of the Kansas–Nebraska Section. It was one of the best meetings I ever attended, with fifty or sixty men in attendance at the several sessions. We took sixteen members from Lawrence and about the same number came down from Nebraska.

We are having so many new applications for membership that we have used up all of the forms. It looks as though we shall have at least ten new members. Will you please send me by return mail a half dozen forms for application.

At the meeting we decided that we shall give a little more publicity to our Section programs, and I was authorized by the members present to arrange for a complete report, together with copies of two papers which were presented, and ask for space in the bulletin, ENGINEERING EDUCATION. Do you think that there will be space available for the purpose of giving this sort of publicity to the Section meetings? We also passed a sort of resolution of approval respecting the report of the Development Committee, and our Secretary was to forward copies of this to President Scott. We will see to it that a copy of this gets to your office.

P. F. WALKER,
Chairman.

New England Section.—The fall meeting of the New England Section of the Society for the Promotion of Engineering Education was held at New Hampshire State College, Durham, October 28, 1922.

The morning session was at 11 A.M. in Demerit Hall, with Dean Anthony presiding. The records of the Providence meeting were read and approved, after which President R.

D. Hetzel of New Hampshire State College gave a very pleasing address of welcome. After several announcements by Dean Crouch, the members were conducted upon a tour of inspection through the laboratories and about the campus. At 12:30 a delicious luncheon was served by the college in the Commons Building.

The second session was called to order at 2:30 in Detroit Hall. Dean Anthony reported the action of the 1922 Convention regarding the proposed reorganization of the S. P. E. E. and explained in considerable detail the work of the Special Committee which is now making a very extensive study of methods for making the Society an effective organ for the development of engineering education.

The Chairman introduced "Coöperation" as the subject for this session. Professor Seavey, of Tufts, reported the activities of the engineering delegates at the Urbana meeting, after which he took up a discussion of various problems connected with the teaching of English to engineers. Other subjects discussed were "Coöperation with Industries" and "Industrial Institutions."

It was voted that the spring meeting of the section should be held at Wentworth Institute, Boston.

Professor Allen proposed a vote of thanks to the President and Faculty of the New Hampshire State College for the many courtesies which were shown during our brief visit with them.

Meeting adjourned at 5 P.M.

The attendance was 62. The following institutions were represented: Tufts College, University of Maine, New Hampshire State College, Wentworth Institute, Northeastern College, Mass. Institute of Technology, Harvard University, Franklin Union, Worcester Polytechnic Institute, Brown University, and University of Vermont, a total of eleven.

H. S. BOARDMAN,
Secretary.

$5,000 FELLOWSHIP PRIZE TO BE AWARDED COLLEGE GRADUATES FOR RESEARCH.

Charles A. Coffin Foundation Announced by General Electric Company for Benefit of Electrical Industry and Engineering Education.

Part of a fund of $400,000 to be set aside by the General Electric Company and to be known as the Charles A. Coffin Foundation, for rewarding and encouraging service in the electrical field, will be devoted to an annual prize of $5,000 to be awarded graduates of American colleges or technical schools with which to continue research work in this country or abroad.

Announcement of the prize and the terms of award has just been made by the General Electric Company as follows:

" Five thousand dollars ($5,000) is to be awarded annually for fellowships to graduates of American colleges and technical schools who, by the character of their work, and on the recommendation of the faculty of the institution where they have studied, could with advantage continue their research work either here or abroad; or some portion or all of the fund may be used to further the research work at any of the colleges or technical schools in the United States. The field in which these fellowships and funds for research work are to be awarded are:—

Electricity,
Physics,
Physical Chemistry.

" A Committee appointed by the Foundation Committee will award such fellowships and funds for research work, with the advice and coöperation of a Committee of three, one to be appointed by each of the following:

National Academy of Sciences,
American Institute of Electrical Engineers,
Society for the Promotion of Engineering Education.

This Committee is to be known as the ' Charles A. Coffin Fellowship and Research Fund Committee ' and the Fellowships are to be known as the ' Charles A. Coffin Fellowships.'

" The Committee to coöperate with the National Academy of Sciences, American Institute of Electrical Engineers, and the Society for the Promotion of Engineering Education will consist of:

E. W. Rice, Jr., Honorary Chairman,

A. H. Jackson, Vice-President,

W. R. Whitney, Director of Research Laboratory."

Other prizes to be awarded under the terms of the Foundation are as follows: $11,000 in prizes for the most signal contributions by employees of the General Electric Company toward the increase of its efficiency or progress in the electrical art; a Gold Medal for the public utility operating company within the United States which, during the year, has made the greatest contribution towards increasing the advantages of the use of electric light and power. The company receiving the Medal will also receive $1,000 for its Employees' Benefit or similar fund. There will also be a Gold Medal for the Electric Railway Company which has made similar contributions in its field.

The Foundation is being established in recognition of the services to the electrical industry of Mr. Charles A. Coffin, founder and creator of the General Electric Company, who recently retired from active leadership at the age of 78.

BOOK REVIEWS.

Applied Calculus. By F. F. P. BISACRE. D. Van Nostrand Company, New York, 1921. xiv + 446 pages. Price $3.75.

From the preface: "This book is intended to provide an introductory course in the Calculus for the use of students of natural and applied science whose knowledge of mathematics is slight. All the mathematics that the student is assumed to know is algebra up to quadratic equations; elementary trigonometry up to the formulae of sines, cosines, and tangents of compound angles; the elements of geometry; and the methods of graphs."

After the usual chapters found in this sort of book we find the following chapters: XIV—Some Problems in Electricity and Magnetism, pp. 266–297. XV—Some Problems in Chemical Dynamics, pp. 298–318. XVI—Some Problems in Thermodynamics, pp. 319–383. Miscellaneous Exercises, 385–401. Biographical Notes, pp. 403–413. The book also contains photographs of seventeen of the leading mathematicians, physicists, and chemists. The problems in the chapters specifically mentioned above serve the purpose of relating the Calculus to fields of science which receive scant treatment in American elementary treatises on the subject. In the earlier chapters of this book, however, the problems are certainly too few to enable the student to master the technique of his subject.

F. A. F.

Vector Calculus with Applications to Physics. By JAMES BYRNIE SHAW, Professor of Mathematics in the University of Illinois. D. Van Nostrand Company, New York, 1922. v + 314 pages. Price $3.50.

According to the preface the volume embodies the lectures on the subject given several times to graduate students. The

eleven chapter headings are Introduction, Scalar Fields, Vector Fields, Addition of Vectors, Vectors in a Plane, Applications, Differentials and Integrals, The Linear Vector Function, Deformable Bodies, and Hydrodynamics.

The introductory chapter is historical and descriptive of the several systems of vector calculus which have been devised. These systems have been classified broadly as geometric and algebraic. Sections are devoted to Hamilton's Quaternions, Multiples, Mobius' *Barycentrische Kalkul*, Grassmann's *Ausdehnungslehre*, and to Gibb's *Dyadics*.

F. A. F.

Advanced Laboratory Practice in Electricity and Magnetism. By PROF. E. M. TERRY, University of Wisconsin. 261 pages, 9 x 5⅝; 131 illustrations. McGraw-Hill Book Co. (1922).

Teachers of junior electrical engineers will be pleased to find such a text as this, so admirably fitting their laboratory needs. Nearly all of the instruments used in the forty-one experiments described in the book are sure to be found in any up-to-date laboratory.

At the outset the electrical units together with their dimensions, and scientific and legal definitions are most clearly set forth. Following this is a thorough description of the important electrical measuring instruments, and thirty experiments, together with adequate theory, on the measurement of resistance, potential difference, current, power, capacity, magnetism, self and mutual inductance, etc.

The illustrations are excellent. They show not only the external appearance of each kind of apparatus and its inside connections, but, also, the arrangement of all the pieces of apparatus used in the experiment. Near the end of the volume are two chapters on "Conduction of Electricity through Gases" and "Electron Tubes," with nine very important experiments. Two exercises on the photometer and optical pyrometer complete the list of experiments.

It is a thoroughly workable text, and I expect it to be widely appreciated.

G. G. B.

Machinists' and Draftsmen's Handbook. PETER LOBBEN, Mechanical Engineer. 487 pp. $3.00. Pub. 1922, D. Van Nostrand.

The elements of arithmetic, algebra, logarithms, weights and measures, geometry, trigonometry, mensuration, strength of materials, mechanics, belts, rope transmission, pulleys, fly wheels, shafting, bearings, gear teeth, screws, pipes, notes on hydraulics, notes on steam, copper wire, electrical terms, shop notes on fits, tapers, cutting lubricants, shrinkage of castings, case hardening, blue printing.

Under the above heads there are excellent tables on squares, cubes, roots, etc., common and hyperbolic logarithms, trigonometrical tables, screw tables, steam and hydraulic tables, etc.

The subject matter is well arranged and presented briefly and very clearly. Examples and figures are given illustrating the rules, for instance as in logarithms, trigonometry, etc., not only covering the general case but also catches and exceptions pertaining to these rules. Every detail is presented in the same clear way so that the average man will not fail to understand.

W. F. W.